

# Game theory and human evolution: A critique of some recent interpretations of experimental games

By: Edward H. Hagen and Peter Hammerstein

Institute for Theoretical Biology, Humboldt University

Presentation: Michel Tolksdorf

# Agenda

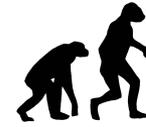
- I. Motivation
- II. Implicit cognitive models
- III. Experimental findings
- IV. Concluding remarks

# Motivation



- Evolutionary stable strategy (ESS) models of cooperation are used in evolutionary biology to describe survival strategies with natural selection
  - A concept closely related to the Nash equilibrium (but “evolutionary” stable)
- Experiments show: humans often do not conform Nash equilibrium predictions
  - Casts doubt on the ESS models as well
  - This is especially interesting in the context of anonymous one-shot games, such as the *ultimatum game* - how to explain altruistic behavior in such games?
- The implicit view of cognition in economic theory suggests *cultural group selection* to explain the deviation in such games
  - Approach is not consistent with the implicit view of cognition in evolutionary biology and is hereby critically reviewed

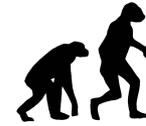
# Implicit cognitive models



Economists view

- Optimizing engine: Human brain
- Assumptions
  - (1) People are rational decision makers that seek to maximize utility
  - (2) Utility is defined in terms of individual benefit
- People have optimizing engine at disposal do deal with novel situations
- Approximation of poorly understood cognitive processes

# Implicit cognitive models



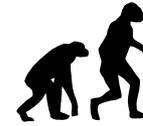
Retain (1) and modify (2)

- Yields *other regarding* utility function, (Fehr and Schmitt, 1999)
- Explanation by cultural group selection

Cultural Group Selection

- Social learning strategies applied when individual learning is costly (*conformist/prestige-biased transmission*)
- Within-group altruism is favored in between-group competition

# Implicit cognitive models



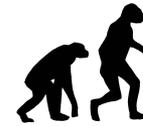
## Economists view

- Optimizing engine: Human brain
- Assumptions
  - (1) People are rational decision makers that seek to maximize utility
  - (2) Utility is defined in terms of individual benefit
- People have optimizing engine at disposal do deal with novel situations
- Approximation of poorly understood cognitive processes

## Biologists view

- Optimizing engine: Natural selection
- Assumptions
  - Utility maximization is external to the individual
  - Brain is an assemblage of evolved, specialized mechanisms
- Information cues trigger behavioral patterns to solve fitness-relevant problems
- Sufficient information necessary to determine the strategic context

# Implicit cognitive models



Retain (1) and modify (2)

- Yields *other regarding utility function*, (Fehr and Schmitt, 1999)
- Explanation by cultural group selection

Cultural Group Selection

- Social learning strategies applied when individual learning is costly (*conformist/prestige-biased transmission*)
- Within-group altruism is favored in between-group competition

Consider (1) is flawed → no rationality

- Humans are not evolved to solve one-shot encounters
- *Mismatch hypothesis*

The Mismatch Hypothesis

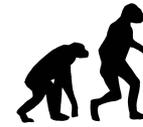
i) *Misapprehension hypothesis*

- Misapprehend situation but act consistently

ii) *Malfunction hypothesis*

- psychological machinery malfunctions  
irrationality is possible

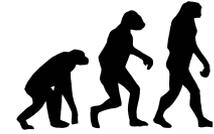
# Implicit cognitive models



## Questions raised

- Are humans adapted to one-shot encounters?
  - It is hard to deny the possibility of additional future encounters
  - If yes, how to trigger responses for one-shot encounters?
    - In most experiments fellow participants are from the same school/town/classes etc.
  - What are the predictions for one-shot encounters considering cultural group selection?
    - Altruism in one-shot games is not evidence for group selected strong reciprocity
- Are humans adapted to anonymous interactions?
  - Reputation usually taken into account, games reflect personal interactions
  - Can experimental games be truly anonymous?
    - Participants questioned about awareness of anonymity and one-shot character

# Experimental findings



Explicit features: instructions, rules and features of the game

- High impact on game play in ways predicted by rational choice theory

Implicit features: subtle cues, independent of formal structure

- Implicit cues can determine game play and extent of cooperation

Importance of culture: reflects social and economic institutions

- Information, which is not specified in the structures or instructions of the game, is used

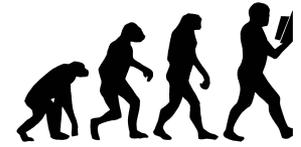
Emotions: “hot” cognition ↔ “cold” cognition (rationality)

- Emotions play a central role when it comes to punishment and retaliation

Variation in game play: “independent” of the first 4 features

- Individual variation of game play exists in all cultures and societies

# Concluding Remarks



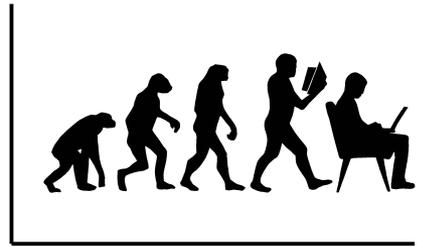
Approach: concept of *frames*

- Knowledge structures/conceptual abstractions used to interpret complex realities
  - Individuals gather informational cues to interpret situations and behave accordingly
  - same facts can be interpreted differently dependent on the framing

Issue: Economic experiments lack contextualization, but are rich in social cues

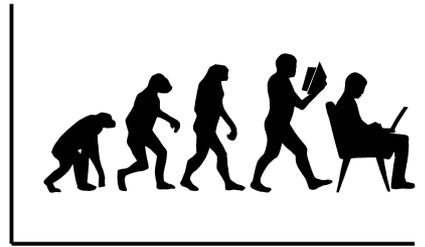
- Hence the behavior of participants is *i)* hard to predict *ii)* hard to comprehend
- Context of the game? Are players allies or enemies? Friends or competitors? In-group or out-group members? Is the game a test of intelligence, skill or personality? A transaction, competition or a collective effort?

- Economists models idealize humans, attributing computational abilities and consistent preferences
- Evolutionary biologists models are unrealistic in their lack of explanation of humans dealing with novel situations



Thank you for  
your attention!

# Appendix



Evolutionary stable strategies (ESS) model specifications

- $x$  and  $y$  are strategies
- $E(x,y)$  is the success of strategy  $x$  in an environment of strategy  $y$

$x$  is an ESS if for all  $x \neq y$  if

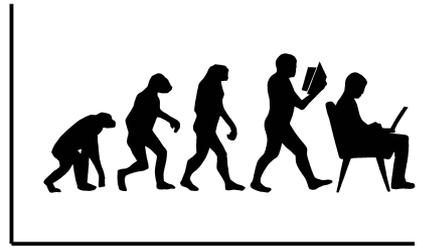
(1)  $E(x,x) > E(y,x)$  **or**

(2)  $E(x,x) = E(y,x)$  and  $E(x,y) > E(y,y)$

strict Nash equilibrium

Maynard Smith's second condition

# Appendix



Other regarding utility function, proposed by Fehr and Schmitt (1999)

- $x_i$  - Payoff of player  $i$
- $x_j$  - Payoff of player  $j$

$$U_i(x_i, x_j) = x_i - \alpha \max(x_j - x_i, 0) - \beta \max(x_i - x_j, 0)$$

with  $0 \leq \beta < 1$  and  $\alpha > \beta$